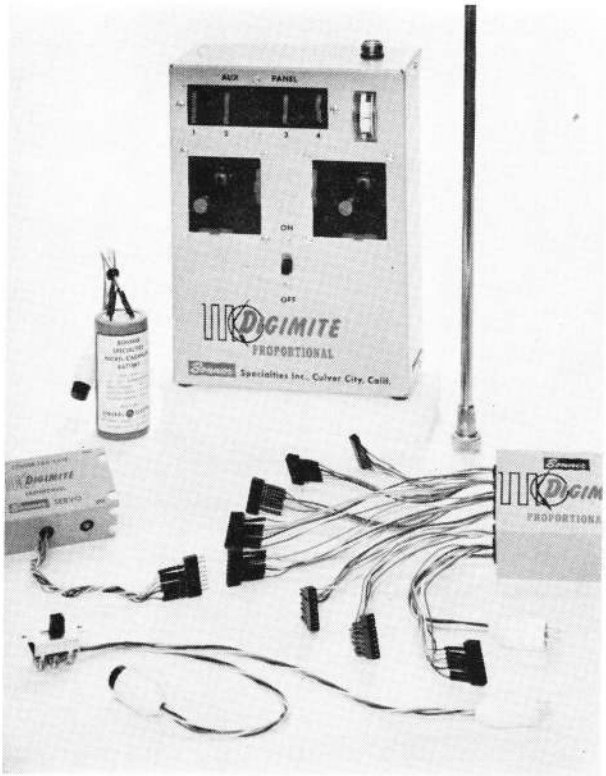
BONNER DIGIMITE



Ergonomics . . . and a $615 price tag. RCM Editors conclude two months of extensive field tests on the Bonner Digimite Proportional System. Here's what you'll get for your money . . .

Ergonomics is a space-age word coined by product research engineers to define "human reaction to a given product." And, apparently, the product research department at Bonner Specialties underestimated the ergonomics of the new Bonner Digimite Proportional System, as evidenced by a back order letter to distributors on January 26, only a few short weeks' after the initial announcement that the Digimite was available for delivery. To quote a portion of that letter — "We want you to know that we have done everything we can to speed and increase production. We have nearly doubled our personnel, we are doing all possible to keep the flow of components coming into our plant, we are working evenings, we are streamlining methods; in short, we are trying our best to fill everyone's order. The overwhelming response is gratifying and we are doing our best to deploy our responsibility to this response."

The phenomenal initial success of the Bonner Digimite is creating a wholly different atmosphere in the radio control industry. While many competitive manufacturers are attempting to reduce their price below the $400 mark by selling direct, the Digimite has been made available through the conventional chain of distributor-dealers with a price tag to the consumer of $615, sans any financing program. While these same manufacturers are trying to render their product more saleable by providing as many options as possible, the Digimite is available in one standard model only. Perhaps these manufacturers have overlooked the one prime factor taken into consideration by the Bonner product research team — that proportional control is not just an expensive toy for the contest flier, but must be a repeatable production item designed for the average RC'er who wants to participate in this new sense of flying freedom and versatility which brings him the utmost in flying pleasure — proportional control.

RCM's test and evaluation studies of this new system began with a call from Cliff Weirick to pick up a production model of the Digimite. Staff members Chuck Waas and Frank Justin traveled to Bonner's Culver City, California plant and were asked to take a system directly from the shipping department from a lot scheduled for immediate shipment to dealers and distributors. These were packed in a form-fitting styrofoam packing case which offers perfect protection during shipment and should be appreciated by the new owner. The unit selected by RCM was on 27.145 mc.

General Description

The Digimite system operates on a digital principle. The transmitter continually sends frames of 16 pulses, the spacing of these pulses providing eight pieces of control information. The manufacturer claims that this type of system is inherently more stable and accurate than other types, with no discernible neutral drift, and allowing the control surfaces to follow the stick with exacting accuracy. The super-

Top, L to R: Frank Justin checks out Digimite servo at Bonner Specialties; Chuck Waas and 'Candy' test ship; a portion of the assembly line at the Bonner plant; one of the steps in the Digimite production. Bottom, L to R: Unique Digimite stick assembly, photographed from inside rear of transmitter. Note mechanical trim feature; Digimite two-deck receiver; servo with half-shell removed — note ball bearings at top; Justin at final inspection; Digimite systems awaiting testing.

heterodyne receiver utilizes three intermediate frequency stages (IF). The detected pulses from the superhet circuit are fed to a logic circuit which examines each digital pulse frame for completeness. In the event of missed pulses, or interference, this circuit rejects the frame of information. Further, if no frames are acceptable for one-quarter second, the receiver and servo system go to fail-safe until valid information is received. During this period, control surfaces are placed very near neutral with the throttle in idle position.

The logic circuit itself is capable of separating the 16 pulses of a frame into 8 pairs — presenting eight pieces of information. These "pulse pairs" are sent to the servos. Each servo has an electronic module which measures the distance between pulses fed into it by the receiver. You could, in effect, consider this module a switch. If the servo mechanical output does not coincide with the stick position of the transmitter, this electronic module, or switch, applies full voltage to the servo motor until this error is canceled. This, of course, is not in proportion to the error. Air loads or linkage friction do not degrade the servo loop performance, as this is a relative factor and not to be considered as condemning an analog-type system. Even though an analog system might not "see" full voltage on an error signal, the voltage it does see is enough to fly model airplanes, as witnessed by prior RCM tests on two analog systems.

Transmitter. The Digimite transmitter is quite unique in many respects and evidences a considerable amount of mechanical engineering consideration. The clever ball and socket stick assemblies keeps dust and dirt out of the transmitter and provides mechanical trim whereas most digital systems use separate potentiometers for trim functions. A two stick arrangement, the left hand stick provides rudder and throttle, while the right hand stick provides aileron and elevator. It is the feeling of the manufacturer that proportional pilots, experienced reed fliers, and beginners quickly adapt to this two stick arrangement, and that experienced reed fliers make the transition much more rapidly when they no longer find the elevator in the left thumb position. This stick configuration permits manipulating all prime controls simultaneously without removing hands or thumbs from any of the controls. In addition, when any of the four auxiliary controls, located on a panel in the upper left portion of the transmitter, are utilized, only the left hand is required to move the levers, while the right hand still handles the prime aerodynamic controls. Since there is a controversy over the easiest stick configuration to fly, most manufacturers provide an interchangeable stick assembly. Bonner does not. Therefore, it was a note of interest to find that both RCM test pilots, both of whom are good reed fliers and neither of whom are experienced pro-

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Bonner Digimite

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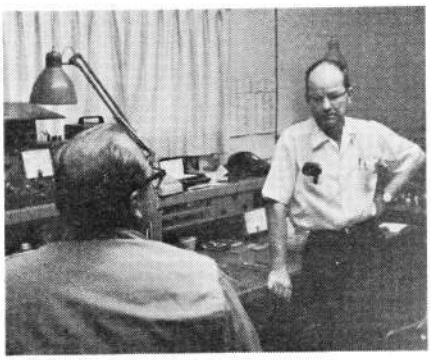

portional pilots, acclimated quite rapidly to this stick configuration, taking new un-trimmed airplanes and flying many successful flights without incident.

A dual meter is provided in the upper right corner of the transmitter, reading either RF output or power supply charge rate. The antenna is a 54″, 5-section telescoping unit which collapses to 12″. The transmitter itself has a relatively high output with one watt input. Selection of electronic components is more than adequate. Silicon transistors are used throughout. The PC board is plated. Externally, sheet metal work is excellent with the overall level of workmanship typical of the high Bonner standards.

Receiver. The Digimite receiver is a superhet built on a two-deck configuration, the top deck containing the dectector and part of the logic circuit, while the lower deck contains the balance of the logic network. There is a great deal of cabling from the receiver due to the availability of eight channels of control. This, however, is remedied simply by taping back four of the cabled leads if the flier is using only four channels of control. The physical size of the receiver is 3″ x 2″ x 1½″. The unit under evaluation was found to be very close to the optimum tuning point as delivered from the factory.

Servos. The new Bonner feedback servo is the first unit we have seen that has taken advantage of good engineering techniques, thereby giving the modeler something they need in the way of a versatile and adaptable servomechanism. The output arm is in the geometrical center of the servo so it can be turned end-for-end without consideration of pushrod position. The servo, itself, is of "clamshell" construction, both halves moulded in a high-impact plastic. The PC board and all internal workings are held in the servo without benefit of hardware. The two halves, when placed together, have four spring clips that keep the servo locked together. All mounting hardware is supplied. All servos are interchangeable with each other with the single exception of the throttle servo. The servo motor is similar to that used in the popular Transmite reed servo, but with a redesigned case. In addition, the permanent magnet used is of the ring type.

Overall servo size is just slightly smaller than the Transmite — 3¼″ x 1¼″ x 1″ with a weight of 3.25 ounces. Thrust is 3½ pounds with a .62 inch travel.

The approach to the distribution of the thrust forces from the control rod are quite novel. The output arm is part of a plate that has a groove on each side. Inside the servo case halves are mating grooves. Fourteen ball bearings to a side fill these grooves, giving in effect, a rack motion that is ball supported. From our experience, this is an excellent way to distribute thrust forces while keeping the thrust arm in perfect alignment with a minimum amount of friction. The use of these ball bearings is one facet that should deter the Digimite owner from indiscriminately opening up his servos, for when the halves are parted, the balls end up hung to the motor magnet, under the PC board, or worse yet, on the workshop floor in the balsa dust! It is suggested that servo service be performed by the Bonner factory, although this is certainly not mandatory if procedural care is exercised.

The Digimite servos are available in two interchangeable styles — center fail-safe and end fail-safe. (The former is used on control surfaces while the latter is used on the throttle). On the four auxiliary channels, either type may be used, however most functions such as flaps or retractable gear would be most suited to the end fail-safe type.

Battery packs. The Digimite Power Supplies are built for Bonner Specialties by General Electric specifically for this system, and both the receiver and transmitter units are rechargeable nickel cadmium supplies. The charger for both the receiver and transmitter is built into the transmitter. A TV type cheater cord is used to energize the charging circuit. The receiver battery pack plugs into the bottom of the transmitter for charging at a rate of 40 milliamperes for 24 hours. One good feature is that neither power supply can be charged alone — both must be charged simultaneously.

The airborne power supply is terminated in such a way that the wiring harness and switch supplied with the Digimite system may, or may not, be used at the discretion of the owner and dependent upon his particular installation. We did note that the wires from the airborne power supply terminate in a solid busbar that is difficult to deflect, making the pack ¾″ longer than is necessary and giving some doubt as to what would happen if they were bent back. However, no problems were encountered during flight tests.

Installation and Tuning. Installation of the Digimite system is quite simple and standard reed practices can be followed. The receiver is packed in foam, as is the battery supply. A servo tray is not mandatory since the Bonner servos can be mounted from the bottom, left, or right sides and proved to be very simple for direct mounting to airframe sidewalls. The manufacturer asks that metal pushrods, or metal-to-metal linkages not be used due to their introduction of noise to the digital circuitry. We used Williams Bros. nylon clevis's in all positions and experienced no mechanical noise problems. Fairly large pushrods should be used in all models, as under some G loads, flexing of light pushrods can cause trim movement. It is recommended by RCM that no less than ⅜″ square balsa pushrods be used in any plane.

The antenna was run out the top of both models and back to the tip of the vertical stabilizer, the best position in relation to the pushrods.

Tuning is accomplished in the installed position. Be sure that the receiver is positioned with the tuning slug easily accessible. A tuning wand is supplied with the system, along with a well-written manual on theory and installation instructions.

Price and Availability. The Bonner Digimite system sells complete with transmitter, receiver, four servos, power supplies, and charger for $615. It is available through all major distributors for sale to the customer through local hobby dealers.

RCM Findings

The test ships used by R/C Modeler

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Bonner Digimite

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Magazine for testing the Bonner Digimite Proportional system was the 1964 Nat's winning Candy design by Cliff Weirick, utilizing a GlasKraft fibreglass fuselage and Meinke Model Engineering pre-made wing, and a Kwik-Fli constructed in the conventional manner from RCM plans.

The first flight of the Candy terminated in a somewhat rougher than normal landing, knocking the entire landing gear assembly out of the wing. This gear assembly, with hardwood bearers, was found to have been only tack cemented in place with standard model cements. Although we understand from the manufacturer of these wings that this practice has been corrected, we suggest that you check the mounting of your landing gear when using this make of wing. Following this first flight, the airplane was slightly out of trim, but the trim levers were so arranged that in-flight trim was easily accomplished. Over fifty flights on the two airplanes were completed without incident, with the possible exception of two "fail-safes" on the Candy, probably due to heavy field use. This is a good sign, certainly showing the fail-safe feature on the system as operational. Both test pilots evidenced an ease in acclimating themselves to the "single stick" configuration (prime controls) and found it to be as equally good as separated sticks. This, then, is simply a matter of operator preference.

The findings of RCM can best be expressed in the tape-recorded statements of both test pilots at the conclusion of a month of flight tests:

Frank Justin: "The Bonner Digimite gear is more than adequate for proportional flying. The level of construction is good. The attitude of the manufacturer towards the consumer is excellent. I would not hesitate to recommend this system to any modeler. I personally don't care for the number of components used, which makes for a higher system failure potential, but in order to obtain eight channels of control, a lesser number of components is not logical. I feel, personally, that I do not need eight channels of control, and that six would be adequate. The manufacturer's intention here is to give the most control availability for the dollar. I don't think that there are specific features on this system that make it worth more to me as a modeler than previous systems have tested, and available at a slightly lower cost. However, based on previous experience with Bonner products, should any problems evolve with the Digimite system, they would be immediately rectified, and the equipment would be modified (within reason) with any changes introduced by the manufacturer.

Chuck Waas: "The Bonner Digimite system represents, for me, the best all around system, both in stick function and reliability of equipment that is available today. I feel, and have felt, completely at ease through all maneuvers — a feeling that I have never fully realized during many years of reed flying in a variety of aircraft. I am, of course, sold on proportional, and have complete confidence in Howard Bonner's new system."

This, then, is the Bonner Digimite Proportional system — an eight channel system priced at $615 and currently in full production. A system that is soundly engineered, well-built, with excellent control response, and seemingly completely reliable. It is recommended by RCM and rated number one of the four systems tested to date.